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Full Length Research Paper

Hash-based document extraction in corporate mobile devices using ontological architectures

Tuncay Ercan

Department of Computer Engineering, Yasar University, Universite cad. No: 35 to 37 35100 Bornova, Izmir-Turkey.
E-mail: tuncay.ercan@yasar.edu.tr. Tel: 00902324115287. Fax: 00902324115020.

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Due to the rapid technological advances in mobile and wireless networking devices, personal computing has moved towards into ad hoc and pervasive environments. Today, the dynamic nature of mobile applications and services have integrated them far more in end-users' lives. Organizations need an effective way of handling their information system for their employees and customers. Mobile devices such as notebook computers, Personal Digital Assistants (PDAs), smart phones owned by the corporate and individual users should be adaptable into the existing business environment. In this paper, we present a hash-based framework, namely SCDE (Shared Corporate Data Extraction) using the current ontological architectures of the corporate domains. This study presents a semantic hashing mechanism formulating an effective search query and assists users with an easier query builder interface. It also extends the features of the "user preferences sub-ontology" and provides an effective performance against well-known weaknesses of mobile devices. Our model also supports future plans of users' interaction with semantic structures, knowledge sharing and new business opportunities for Corporate Information Management Systems.

Key words: Mobile ontology, data extraction, hashing, semantic search.

INTRODUCTION

Recent advances in mobile computing have given people great flexibility to use the Internet and the services provided by organizations. The function of working freely from time and place is the most important aspect of mobile computing. Employees can always access their organizational data, download or upload necessary documents, conduct organizational business and interact with other employees. Today's mobile communication infrastructures are generally centralized and require internetworking devices like access points and base stations. The heterogeneity and well-known constraints of mobile devices make automated discovery and management of web based information systems difficult, while the storage and processing capabilities still need centralized structures. On the other hand, when we looked at the current distributed architectures classified as "client-server", "peer-to-peer", collaborative or service oriented, they all focus on sharing common business services. Storing and retrieving the related data is an important function for these systems.

However, the increased computational power, new applications, and large memories have enabled mobile devices to search quickly in the large collections of documents and pre-organized ontological architectures. Various mobile devices used in different environments should support user activities and allow them do their jobs. Contextual information such as location, time, user and device profiles enable user adaptation according to the requirements like "where they are" and "what to run". The simplest description of context data can only be organized with ontologies (Dey, 2001; Flanagan et al., 2003). Ontologies are widely used in web technologies, however there are still difficulties in building them properly (Shin et al., 2009; Xu et al., 2009; Veijalainen, 2008) since they require a large amount of computational power and memory resources that might not fit the properties of mobile devices. Additionally, pervasive systems include a high number of mobile devices and need access to different ontology-based information repositories with different interfaces.

In this paper, we define an adaptable architectural framework named SCDE (Shared Corporate Data Extraction) that allows using an ontological architecture in the centralized server side and an automated hashing mechanism in the client side. First, we extend the keyword and the related data descriptions in the corporate servers as new concepts. Concepts in the mobile, personal and corporate sub-ontologies correspond to a name, title or topic in our SCDE. We have a better chance of building queries by using these words. Second, our hybrid approach is able to execute an efficient query matching by using the common similarity algorithms with the embedded peer address feature in XML messages. This structure extends the features of the user preferences and provides an effective performance against well-known location discovery weakness of mobile devices. This paper also has the following contributions:

i) The extension of ontological structures into the mobile devices,
ii) A novel SCDE (Shared Corporate Data Extraction) architecture,
iii) An adaptable framework for companies,

Literature review

The use of ontologies in pervasive systems has been researched and applied to a large number of studies. They can be ranged from the discussions and realization of mobile ontology in different distributed systems to the enhancements of semantic reasoning technologies for information retrieval. To the best of our knowledge, considering the increasing growth of mobile applications, Glover and Davies (2005) described an ontology of mobile devices and user profiles. Thant and Naing (2005), Bianchini et al. (2006) proposed a migration framework through the ontology-based approaches for mobile applications to enable a seamless user-experience while the users move around in a pervasive computing environment.

Antovski (2007) explained the implementation and utilization of different mobile services and proposed fuzzy logic ontology for the citizens' access devices in a government project. Veijalainen (2008) reviewed different ontologies in the field of computer science and introduced mobile ontologies. He also discussed the ontology creation issues, business aspects and some basic requirements for computer systems. Villanueva et al. (2009) defined a framework that automatically generates a specific implementation of different mobile access patterns and used ontology by means of Web Services. Malizia et al. (2010) developed ontologies by investigating accessibility guidelines, emergency response systems, communication systems and explained their information needs for different kinds of users and conditions. Several research efforts have recently emerged in the field of service discovery based on semantic data representation and technologies. They used flexible matching techniques between user requirements and service capabilities in dynamic wireless environments.

Faro et al. (2003) illustrated an ontological approach for the design of Mobility Information Systems. Their semantic approach was independent from the system implementation. They facilitated data collection and the control of remote devices. Jung et al. (2005) proposed a web information framework on wireless networks. They generated templates for users' input and semantic tagging in order to extract particular pieces of information and send them to the corresponding users instead of sending the whole text. Kalaoja et al. (2006) and Mena et al. (2006) presented semantic ontologies for home services and how mobile users easily and efficiently reach necessary application software. They presented an analysis of vocabulary ontologies for the technical features of mobile devices and the location and access methods of various remote databases. Nedos et al. (2006) presented a semantic service discovery model for distributed ontology matching and defined a protocol to disseminate ontology concepts. Jeon et al. (2008) and Lee et al. (2009) presented semantic search systems based on personalized preferences/keywords and built ontologies for mobile devices and wireless networks.

Nummiaho et al. (2009) discussed how existing semantic knowledge basics can be utilized in creating explanations about the challenges of mobile devices. Corradi et al. (2005) and de Almeida et al. (2006) proposed semantic support functionality to mobile portable devices by using context data like user/device profiles, behaviours, movements, necessities and policies presented in an ontological approach. Han et al. (2007) showed how such an adaptation of the Semantic concepts could help browsing with mobile devices and address content personalization.

Yuan and Yeh (2006); Niazi and Mahmoud, (2009) presented frameworks for content sharing ontologies based on user preferences and device capabilities. They provided a semantically enriched profile-based service description and integrate it with the ontology. Park (2010) proposed a device recommender system that selects automatically customized devices for composing a user required service and uses context-aware inference in peer-to-peer environments.

Mobile pervasive systems use keyword searching to locate and exploit required services in the dynamic environments. Mobile peers have not only stored semantically close services in their local database, but also found and requested the services from their neighbours. Different indexing mechanisms are used to decrease the data access time in different devices. Parent et al. (2001) used a combination of Information Extraction techniques by analyzing single pages, ontologies, and the mining of a user's previous search

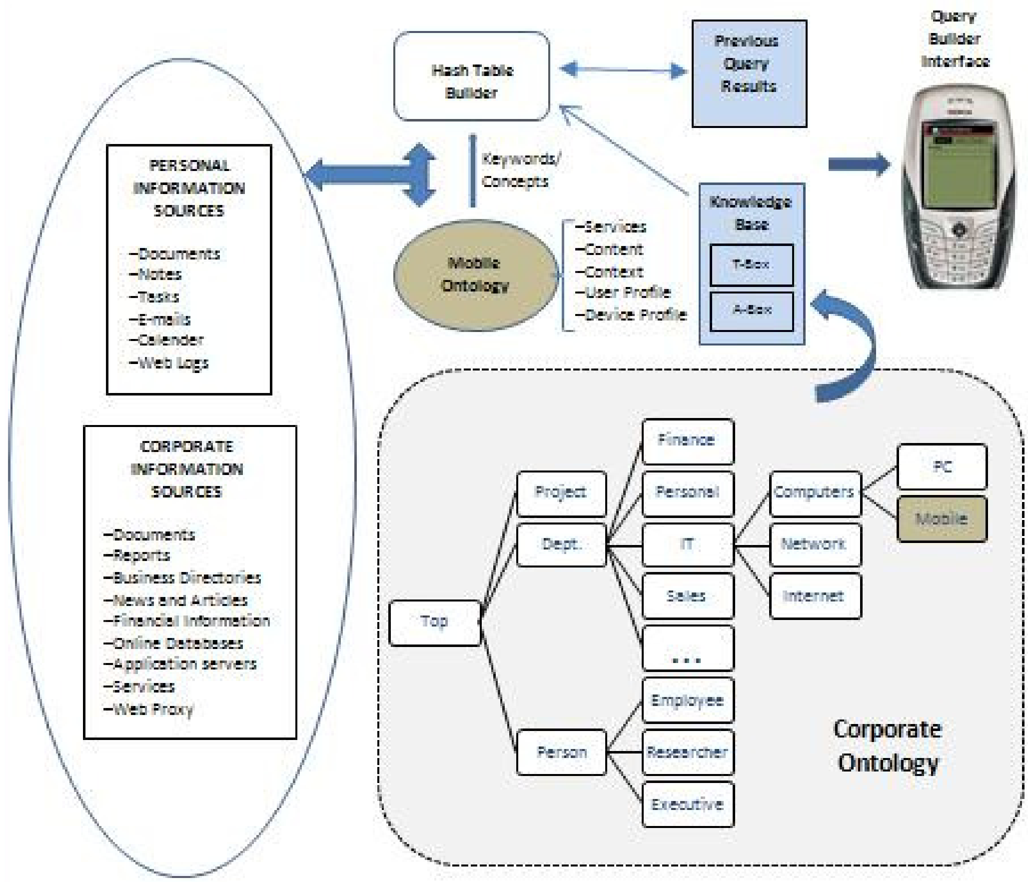

Figure 1. Integration of Mobile Sub-Ontology into the Corporate Ontology.

log in order to find more suitable query responses. While indexing is based on a unique and sorted search keyword, hashing uses a hash function to locate different records with different keywords. The use of hash tables in mobile networks has already been explored to some extent by Kellerer et al. (2005). This paper focuses on two different points of view: an applicable standard for corporate ontological architecture of mobile devices and the semantic hashing mechanism to manage more efficient query building mechanism in mobile nodes.

Proposed mobile ontology

The information exchange in e-business has been supported by new technologies like Semantic Web and mobile technologies. While semantic approaches address the issues of information complexity and machine under-standing, mobile systems enable users to exploit these capabilities at any time and place. Semantic information is kept on ontologies that include shared and common modelling of different domains. Ontologies are used in many knowledge management applications by the organizations and improve the semantic collaboration among user devices.

Distribution of RDF (Resource Description Framework - an XML-based language for creating common metadata models about the particular information resources for the Web contents of a company domain) models of different mobile devices in a pervasive environment provide a flexibility for the applications, computing resources and information. If mobile peers use client-server architectures in a centralized domain, their way of information retrieval is based on centralized know-ledge repositories and specific servers (application, web, database etc.). But, if they share files over the Internet without any centralized resource, there is only one possibility for robust and scalable information delivery which is Semantic Web.

Inspired by the model worked by Khushraj and Lassila (2005) for the integration of semantic descriptions of Web services with semantic models of the user's local data, we thought to enable employees of any company use their current context status, web history, personal data and corporate data by using an underlying semantic model among mobile peers (Figure 1). Semantic grouping of mobile users with their collaborative functions like service creation and service discovery in order to handle query request-response mechanisms requires ontological implementations. Our architectural methodology describes the flow of personal information and business data among corporate mobile users. User Profile data indicates different user preferences related with what information they generally request and when/ where/how they do this. Parameter ontology addresses different services and their related data in service ontology. The example below gives the idea of how we set up a service by using the necessary parameter words and current profile data with a query phrase typed in the user interface. User profile has the hierarchical information of users' favourite teams, calendar has the scores for each week and a query typed in user's own device first checks the local database.

```
(A)    Score     : (Football, team->Score)
(A*)   Week 9    : (Fenerbahce->{Score})
```

Service ontology enables users to reach query caches in their mobile devices or locate the service in another mobile node which has the greatest similarity values with the received query. In order to create a linear relation among organizational entities, there should be a predefined tree structure, classification of services, nodes that owned the services, and most importantly necessary keywords to search for the requested query results. Schrimpsher and Etzkorn (2009) developed a software engineering approach that improves a correct query handling methodology over the ontological structure. They considered that agents on the mobile devices need a subset of web service ontology and discussed to create an ontology sub-graph. This also affected our motivation about necessary ontologies for the semantic management of corporate and personal information repositories. By using such a system, the mobile users will store and retrieve information about their contacts, personal and organizational activities, services, events and documents. With the appropriate interface designs, the ontologies and query builders enable an easily customizable personal storage in mobile devices that will serve as a memory aide for the user.

Ontological architecture

We focus on structures like Personal and Corporate Information Sources for a business environment and specific information in an application domain. Thus, we avoid discussing formal ontology aspects like taxonomies, axioms, conceptual graphs and construction details. Our purpose is to provide a basic and simple framework to facilitate information exchange in a mobile business environment. When dealing with organizational information, we come across with different interfaces of web services, web pages, official letters and documents, technical reports, e-mails etc.

Many of the employees require this type of information through client-server, collaborative or peer-to-peer architectures. Dynamic characteristics of mobile networks make discovery of predefined services difficult. Using ontological structures increases the consensus of different services and presents a common representation. Matching the distributed ontologies in each mobile device provides a considerable scalability in the network environment. While building sub-ontology for our own corporate mobile devices, we examined various sub-ontologies such as services sub-ontology, content sub-ontology, context sub-ontology, application sub-ontology, trust sub-ontology, device profile sub-ontology and user profile sub-ontology.

Mobile databases like UltraLite, DB2e, Microsoft SQL Server Compact, Oracle9i Lite provide mobile users to enter, store and retrieve their data while they move. Information should be synchronized with a centralized server-based database in the organization from time to time. We accept that default ontological implementations with semantic comparability provide a higher degree of matching based on hierarchical ontology concepts when query searches run. But, applying a distributed hash table strategy among peers and keeping previous query caches in each mobile device local database will offer more efficient insertion and retrieval mechanism.

Semantic hashing

The common way of keyword search in Distributed Hash Tables (DHTs) is to construct distributed indexes of each different keyword. But it suffers from the limited resources (processing, bandwidth, and storage) in mobile systems. Wenhui et al. (2007) present a scalable keyword search for DHTs in domain ontology of mobile peer systems. Hash table holds the records (hash value, keyword, and related data) according to the unique keys extracted from mobile ontology concepts, and instances. Each entry into the hash table takes one-by-one key and its value as parameters. The important factor in mobile information sharing is the proper and understandable expression of the XML-based queries including the search keys.

Daswania, Garcia and Yang (2003) distinguished key-based, keyword-based and schema-based systems. While key-based systems request documents with a unique hash-key assigned to their names, keyword-based systems look for keywords like title or topic and schema-based systems use semantic data for documents. Schema-based systems also allow users to describe background knowledge in repositories and automatically support their queries with personalization of user profiles. Our query mechanism adapts these three different cases explained as below:

i) Given the key extracted from ontology concepts->keyword-based systems
ii) Search documents related with the keyword and retrieve related data with its unique hash value->key-based process
iii) Pre-search in previous query results stored in local

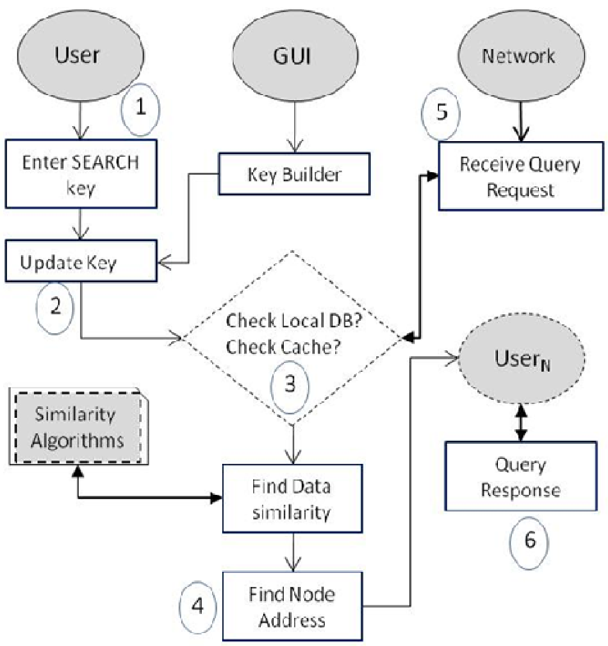

Figure 2. Methodological steps for query request and response.

cache->schema-based systems.

METHODS

Our hash table consists of keyword values/concepts coming from the mobile ontology in the centralized architecture. We create the unique hash values of these keywords and record them as document file names, paths, or URL addresses as parameter values in our DHT. Searching begins with the key value inserted by the user. Here, the client device has two options. It either checks the previous query results and makes a query word comparison in the local database or sends the query into the network. After the query is forwarded into a new mobile node, keyword matching is done by using the necessary similarity algorithms and later the hash value is detected in order to see the associated information which is tried to retrieve as the result of the query. Figure 2 explains our methodological steps in detail. All the possible values and keywords are known in advance and this make it easier to organize a perfect DHT in advance. The hash table created for each node is flooded into the network by web services since flooding is the simple forwarding of a packet between neighbour nodes and used for distributing routing information.

The Tables within the nodes would tell us exactly where to find the proper response. There are 6 different steps that require different processes/algorithm to run. First one is the query formulation and begins with the user edit in the user query interface. Whenever the user selects (drop-down lists) or types (auto-complete) a single word by the help of query builder, it is checked if there is existing previous information in the local database or sent to the network. Each node checks the key value and tries to see a hash value related with the coming keyword as an XML message envelope or forward to another node. If there is a proper response, the information value is sent back to the requester since its network identification written in the request. The user in the source node accepts this or makes another query request. If there are still unanswered queries, a new query is formulated as an HTTP request in order to ask the web server for semantic comparison.

Whenever the nodes upgrade their local hash tables with new keywords, they send "put (hash value, data)" messages to neighbour nodes in the network domain. So, iterative lookups for future query comparisons reduce useless forwarding of full table changes. If necessary documents and filenames are divided into different keywords, then each of these keywords is separately hashed and stored in the local database with the corresponding keywords and filename. A search with one of the keywords finds the proper node first and retrieves the filenames that contain the keyword. Since every filename in the list has its hash value, the chosen file can then be obtained. Once these components are in place, a typical use of our hash table mechanism for storage and retrieval may proceed as follows (Figure 3).

We suppose the key space is the set of 8-bit strings. To store a file with given keywords (that are hierarchical concept words coming from the ontologies) in the DHT, the SHA-1 hash of filename is generated, producing a 160-bit key K. In order to have more space in memory, we just get the first 2 characters of the string key.

```
$NewValue=hexdec(Substr(sha1("keyword"),0,1)
```

Even though this seems a small value, we just put it an example of how our hashing process works while listing/inserting each new keyword. It implements a byte value for each new item in the range of "0 to 0xFF". In order to provide synchronization between associated neighbour nodes a "put (NewHashValue, keyword)" is forwarded from any node.

This message updates hash tables located in each neighbour (Figure 4). The user starts with a single keyword query by using the device interface in Figure 1. This user Interface enables the proper query formulation based on the semantics of mobile and corporate ontologies by using drop-down lists or automatic word completion features. Query word is broad-casted with the same message type through the overlay network until it reaches the single node responsible for key "keyword" as specified in its local hash table (L_{HT}). This node knows where this query comes from by looking hash value which is 8000 in Figure 3. The first 2 digits (80) is the host ID (.128) and the last two digits are the query word (00=Company).

Let's consider N_{FO} which is "Host ID= .240" checks its hash tables and discovers "keyword Company" is in HT_{7C} not in its L_{HT}. It ignores the query message and let N_{7C} answers it by preparing another message directly to N_{80} as (keyword, related data).

DISCUSSION

Mobile applications must adapt to changing contexts and resource availabilities as they migrate from one environment to the next. The need of using mobile ontology in a corporate domain is primarily motivated by the desire of having a common vocabulary for the mobile corporate devices. This common vocabulary is intended to be used by different sub-ontologies and components so that they can communicate with each other. Based on the detailed information in the device profile, personalized adaptive mobile knowledge management system can deliver or transfer necessary context and content to the users. Organizations run "need to know" access rights to their networked resources since their mobile users have different levels of security clearances in a mobile business environment. The exchange of business

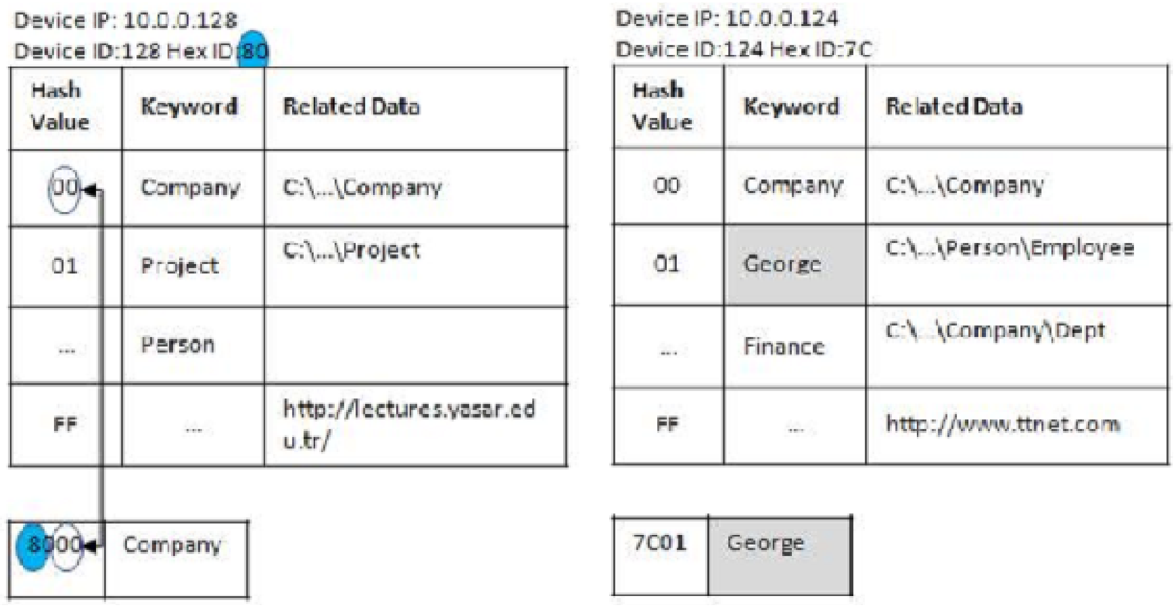

Figure 3. Proposed hashing table.

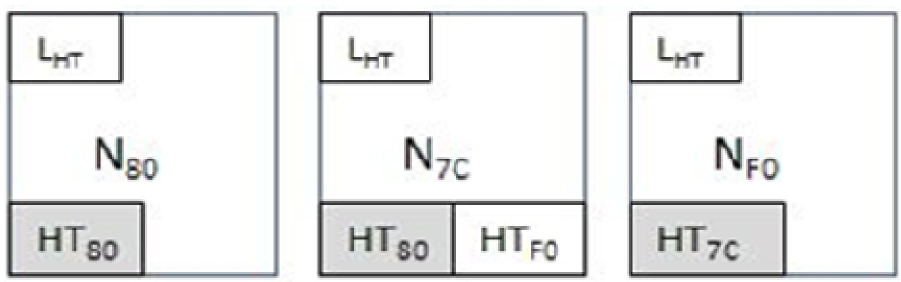

Figure 4. Status of Hash tables in each node.

information among employees in different departments requires that the whole system should operate with various levels of classified data. The mobile ontology should be managed as a collaborative effort among the major players in mobile communications area, such as operators, manufacturers, and scientific community.

Conclusion

We have presented the architectural framework of Shared Corporate Data Extraction (SCDE) that allows us to use a corporate and mobile ontology in the centralized server side and an automated hashing mechanism in the client side. We have studied the combination of two developing research areas Semantic Web and information Extraction. It should be noted here that taking into account of the variety of different user groups and requests, Corporate and Mobile Ontologies may become a basic core of structures that will be easily extensible to different user and device profiles such as “Researcher”, “Professor”, “Student”, “Architect”, ”Device Features” etc. Users generally have no idea about their networking domain terminologies and can not easily find necessary information that they need. We tried to make a user friendly web information service by a template query builder that can provide users an effective information retrieval process. Considering that user’s personal ontology contains information for the user and domain of interest, s/he should be able to manipulate and update it easily.

Our proposed model successfully formulates effective search queries based on hierarchical concepts in the semantic architecture and a previously determined user profiles. It improved the effectiveness of document indexing mechanisms. Overall, we thought we were able to discuss about the current mobile application trends and mobile semantic approaches from our application point of view. In a peer-to-peer collaborative environment, mobile networking devices exchanged and utilized their potential information resources by an effective discovery mechanism based on device identifications and

Distributed Hash Tables (DHTs). Ontologies also enabled us to gather and analyze personal and corporate data. The conceptual idea and applicable algorithm in our manuscript gives the idea of hash-based extraction which also uses the intelligent location discovery of peer nodes in XML based message envelope. An applicable user interface for semantic searches can be improved by software engineers as a promising future work. The increasing number of mobile devices in a corporate domain requires new addressing descriptions in XML-based message envelopes.

REFERENCES

Antovski L (2007). Improving service matching in m-government with soft technologies. IEEE 18th International Symposium on Personal, Indoor and Mobile Radio Commun., 1(9): 4005-4008.

Bianchini D, De Antonellis V, Melchiori M, Salvi D (2006). Lightweight ontology-based service discovery in mobile environments Seventeenth International Conference on Database and Expert Systems Appl. Proceed., pp. 359-364.

Corradi A, Montanari R, Toninelli A (2005). Adaptive semantic support provisioning in Mobile Internet environments. International Symposium on Applications and the Internet (SAINT), pp. 154-157.

Daswania N, Garcia MH, Yang B (2003). Open problems in data sharing peer-to-peer systems. In Proceedings of the 9th International Conference on Database Theory (ICDT), Siena, Italy.

de Almeida DR, Baptista CD, de Andrade FG (2006). Using ontologies in context-aware applications Seventeenth International Conference on Database and Expert Systems Applications, Proceed., 349-353.

Dey AK (2001). Understanding and using context. Personal Ubiquitous Comput., 5(1): 4-7.

Faro A, Giordano D, Musarra A (2003). Ontology based intelligent mobility systems. IEEE International Conference on Systems, Man Cybernetics, Conf. Proceed., (1-5): 4288-4293.

Flanagan JA, Himberg J, Mantyjarvi J (2003). Context and facilitating user interaction in mobile devices. Artificial Intelligence in Mobile System (AIMS), Seattle, USA, pp. 66-73.

Glover T, Davies J (2005). Integrating device independence and user profiles on the Web. Bt Technol. J., 23(3): 239-248.

Han EJ, Yang JY, Yang HK, Jung KC (2007). Automatic mobile content conversion using semantic image analysis. In J. A. Jacko (Ed.), Human-Computer Interaction, Pt 3, Proceedings, 4552: 298-307.

Jeon H, Kim T, Choi J (2008). Mobile Semantic Search using Personal Preference Filtering. 4th International Conference on Networked Computing and Advanced Information Management, SEP 02-04, pp. 531-534.

Jung JJ, Park SB, Jo GS (2005). Semantic template generation based information summarization for mobile devices. In S. Shimojo, S. Ichii, T. W. Ling and K. H. Song (Eds.), Web and Communication Technologies and Internet -Related Social Issues – Hsi, 3597: 135-143.

Kalaoja J, Kantorovitch J, Carro S, Miranda JM, Ramos A, Insticc (2006). The vocabulary ontology engineering for the semantic modelling of home services. 8th International Conference on Enterprise Information Systems (ICEIS 2006) , MAY(23-27): 461-466.

Kellerer W, Schollmeier R, Wehrle K (2005). Peer-to-Peer Systems and Applications, LNCS, 3485: 401-417.

Khushraj D, Lassila O (2005). Ontological approach to generating personalized user interfaces for web services. In Y. Gil, E. Motta, V. R. Benjamins & M. A. Musen (Eds.), Semantic Web - ISWC, Proceed., 3729: 916-927.

Lee TH, Kim JH, Kwon HJ, Hong KS (2009). Keyword-based Semantic Retrieval System using Location Information in a Mobile Environment. 2nd Int. Symposium on Web Inf. Syst. Appl., (22-24): 434-438.

Malizia A, Onorati T, Diaz P, Aedo I, Astorga-Paliza F (2010). SEMA4A: An ontology for emergency notification systems accessibility. Expert Syst. Appl., 37(4): 3380-3391.

Mena E, Illarramendi A, Royo JA, Goni A (2006). A Software Retrieval Service Based on Adaptive Knowledge-Driven Agents for Wireless Environments. ACM Trans. Autonomous Adaptive Syst., 1(1): 67-90.

Nedos A, Singh K, Clarke S (2006). Mobile ad hoc services: Semantic service discovery in mobile ad hoc networks. In A. Dan & W. Lamersdorf (Eds.), Service Oriented Computing - ICSOC, 4294: 90-103.

Niazi R, Mahmoud QH (2009). An Ontology-Based Framework for Discovering Mobile Services. 7th Annual Conference on Communication Networks and Services Research, Moncton, CANADA, (11-13): 178-184.

Nummiaho A, Vainikainen S, Laakko T (2009). Utilizing Existing Semantic Knowledge Bases for Creating Annotations on Mobile Devices. 10th Int. Conf. Mobile Data Manage, Taipei, TAIWAN., (18-20): 554-559.

Parent S, Mobasher B, Lytinen S (2001). An adaptive agent for web exploration based of concept hierarchies. In Proceedings of the 9th International Conference on Human Computer Interaction, New Orleans, LA.

Park JH (2010). A Recommender System for Device Sharing Based on Context-Aware and Personalization. Ksii Trans. Int. Inf. Syst., 4(2): 174-190.

Schrimpsher D, Etzkorn L (2009). An Empirical Quality Model for Web Service Ontologies to Support Mobile Devices Esem: 3rd Int. Symposium on Empirical Software Eng. Measure., pp. 448-451.

Shin I, Kawamura T, Nakagawa H, Nakayama K, Tahara Y, Ohsuga A (2009). ONTOMO: Development of Ontology Building Service Evaluation of Instance Recommendation Using Proper Noun Extraction. Principles of Practice in Multi-Agent Systems, LNCS., 5925: 143-158

Thant KP, Naing TT (2005). A migration framework for ubiquitous computing applied in mobile applications. 6th Asia-Pacific Symposium on Information and Telecommunication Technologies, NOV 09-10, Yangon, MYANMAR, pp. 213-218.

Veijalainen J (2008). Mobile ontologies: Concept, development, usage, and business potential. Int. J. Seman. Web Inf. Syst., 4(1): 20-34.

Villanueva FJ, Villa D, Barba J, Rincon F, Moya F, Lopez JC (2009). Ontology access patterns for pervasive computing environments. In P. Mikulecky, T. Liskova, P. Cech and V. Bures (Eds.), Ambient Intelligence Perspectives., 1: 236-244.

Wenhui M, Wenfang W, Jing L (2007). Scalable keyword search based on semantic in DHT based peer-to-peer system. Proceedings of the 2nd international conference on Scalable information systems (InfoScale '07), Suzhou, China, 28: 1-4.

Xu YC, Gu JZ, Yang J, Zhang ZY, Soc IC (2009). An Ontology-based Approach for Mobile Personalized Recommendation. IITA Int. Conf. Serv. Sci. Manage. Eng. , JUL 11-12, Zhangjiajie, PEOPLES R CHINA, pp. 336-339.

Yuan ST, Yeh ML (2006). Mobile P2P automatic content sharing by ontology-based and contextualized integrative negotiation. In J. Lee, J. Shim, S. Lee, C. Bussler andS. Shim (Eds.), Data Engineering Issues in E-Commerce and Services, Proceed., 4055: 115-132.